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Pakkasela, Johanna

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Age-specific incidence of allergic and non-allergic asthma

Johanna Pakkasela[1,2*], Pinja Ilmarinen[3], Jasmin Honkamäki[2], Leena E. Tuomisto[3], Heidi Andersén[4], Päivi Piirilä[5], Hanna Hisinger-Mölkänen[6], Anssi Sovijärvi[5], Helena Backman[7], Bo Lundbäck[8], Eva Rönmark[7], Hannu Kankaanranta[2,3†] and Lauri Lehtimäki[2,9†]

Abstract

Background: Onset of allergic asthma has a strong association with childhood but only a few studies have analyzed incidence of asthma from childhood to late adulthood in relation to allergy. The purpose of the study was to assess age-specific incidence of allergic and non-allergic asthma.

Methods: Questionnaires were sent to 8000 randomly selected recipients aged 20–69 years in Finland in 2016. The response rate was 52.3% ($n = 4173$). The questionnaire included questions on e.g. atopic status, asthma and age at asthma diagnosis. Asthma was classified allergic if also a physician-diagnosed allergic rhinitis was reported.

Results: The prevalence of physician-diagnosed asthma and allergic rhinitis were 11.2 and 17.8%, respectively. Of the 445 responders with physician-diagnosed asthma, 52% were classified as allergic and 48% as non-allergic. Median ages at diagnosis of allergic and non-allergic asthma were 19 and 35 years, respectively. Among subjects with asthma diagnosis at ages 0–9, 10–19, 20–29, 30–39, 40–49, 50–59 and 60–69 years, 70, 62, 58, 53, 38, 19 and 33%, respectively, were allergic. For non-allergic asthma, the incidence rate was lowest in children and young adults (0.7/1000/year). It increased after middle age and was highest in older age groups (2.4/1000/year in 50–59 years old).

Conclusions: The incidence of allergic asthma is highest in early childhood and steadily decreases with advancing age, while the incidence of non-allergic asthma is low until it peaks in late adulthood. After approximately 40 years of age, most of the new cases of asthma are non-allergic.

Keywords: Asthma, Allergic, Non-allergic, Adult, Child, Adolescent, Incidence, Prevalence, Onset, Age-specific

Background

Rackemann was the first to introduce the concept of extrinsic/allergic and intrinsic/non-allergic asthma in 1947 and thus described the first phenotypes of asthma [1]. Over recent decades, cluster analyses have confirmed that asthma is more of a heterogeneous disorder rather than just a single disease. Several phenotypes have been introduced in addition to the ones established 70 years ago [2–6], but differentiating the phenotypes in clinical practice can be challenging. One of the answers appears to be the age of asthma onset and subsequently the division into childhood/early-onset and adult/late-onset asthma [6, 7].

Childhood asthma is commonly associated with allergy [8, 9]. Large cohorts have shown allergic sensitization as a risk factor for development [10, 11] and persistence of asthma in childhood [12]. On the other hand, there is a lack of comprehensive studies on the relevance of allergy to adult asthma. Although allergic sensitization has been reported as a risk factor for asthma in adults [13, 14] and adult-onset asthma [15], adult asthma is more often non-allergic than allergic [7, 16]. Also, the rates of allergic sensitization in adult-onset asthma are mostly below 50% [15–17]. According to a recent Finnish cluster analysis, allergic asthma diagnosed in adulthood was often associated with respiratory symptoms already during childhood [5]. However, contradicting results do also exist and a U.S.-based study reported only a slight

* Correspondence: johanna.pakkasela@tuni.fi
†Hannu Kankaanranta and Lauri Lehtimäki contributed equally to this work.
[1]Department of Respiratory Medicine, Tampere University Hospital, FIN-33521 Tampere, Finland
[2]Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland
Full list of author information is available at the end of the article

difference in allergic sensitization in early- and late-onset asthma (72 and 63% in subjects with asthma onset before and after 40 years of age, respectively) [18].

It appears that there is a lack of knowledge on the allergic and non-allergic phenotypes of adult-onset asthma and the relation between allergy and asthma onset age. Our aim was to study the association between asthma onset age and allergy by assessing age at diagnosis and age-specific incidence of asthma in adult asthmatics with and without allergic rhinitis in a population-based postal questionnaire study conducted in Finland.

Methods

Study design and population

The present study is part of the FinEsS (Finland-Estonia-Sweden) study, which is a postal questionnaire study on respiratory epidemiology conducted in collaboration in these three Northern European countries. Similar postal surveys were conducted in 1996, 2006 and 2016. The present study sample is part of the latest survey conducted in Finland in February 2016 and is formed from a random sample of 8000 subjects aged 20–69 years from the population in western Finland (Hospital Districts of Vaasa and Seinäjoki). The study sample was obtained from the Finnish Population Register and it was matched to the age and gender distribution of the population in the geographical area of our study. Finland is a bilingual country and the registered native language of a subject determined whether questionnaire in Finnish or Swedish language was used. The questionnaire was sent to a random sample of 7986 subjects after exclusion of subjects with unknown address. Two reminders were sent to those not responding. The sample size was 7942 subjects after further exclusion of subjects with non-analyzable data as shown in Fig. 1. In total, 4173 subjects responded yielding to a response rate of 52.3%. Of the responders, 206 were excluded because of missing data regarding smoking habits and thus, the actual sample size was 3967 responders included in the study. The study protocol was approved by the Ethical Committee of Helsinki University Hospital (approval number 200/13/03/00/15).

Study area

The study area is mainly rural with two major towns (Seinäjoki and Vaasa, about 62,000 and 68,000 inhabitants, respectively). It has a subarctic climate and the yearly average temperature is 4 °C (from −7 °C in the winter to 17 °C in the summer) [19]. The most common allergic sensitizations in Finland are against dogs, cats and pollens whereas sensitization to house dust mites and molds is less common [20].

Questionnaire and definitions

The FinEsS questionnaire was developed from the Obstructive Lung Disease in Northern Sweden (OLIN) questionnaire, which is modified from the Swedish translation of the British Medical Research Council (BMRC) questionnaire [21]. The questionnaire includes questions on respiratory diseases, symptoms, medication and comorbidities, risk factors and occupational factors considered relevant in respiratory epidemiology.

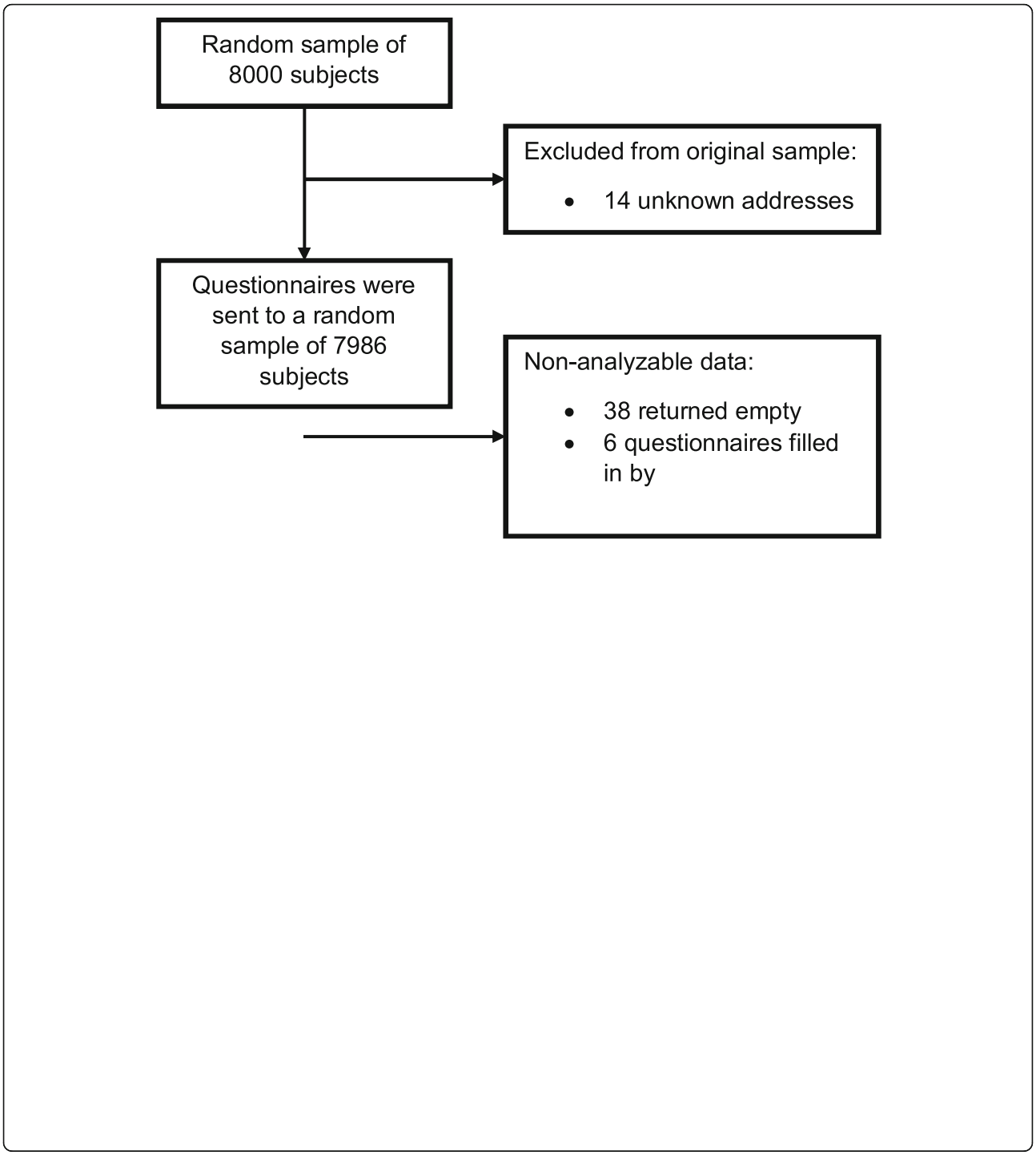
A physician-diagnosed asthma was defined by an answer "yes" to the question "Have you been diagnosed by a doctor as having asthma?". Age at asthma diagnosis was determined by an answer to the question" What age were you when asthma was diagnosed?". Allergic rhinitis was defined by an answer "yes" to either of the questions "Have you been diagnosed by a doctor as having allergic rhinitis caused by pollens (caused by e.g. birch, grass, mugwort)?" or "Have you been diagnosed by a doctor as having other allergic rhinitis (caused by e.g. cat or dog, but not pollen)?". Allergic conjunctivitis was defined by an answer "yes" to the question "Have you been diagnosed by a doctor as having symptoms of allergy in your eyes?". Age at diagnosis of allergy was not asked for. We used the presence and absence of allergic rhinitis as an indication of asthma being allergic or non-allergic, respectively. A sensitivity analysis was made by using the presence of either allergic rhinitis, allergic conjunctivitis or both as an indication of allergic asthma. Current smokers were considered those who reported smoking currently or during the 12 months preceding the survey. Ex-smokers reported previous smoking but had quit smoking at least 1 year prior to the survey. Never smokers did not report current or previous smoking.

Statistical analysis

Reconstructing age-specific incidence of asthma from cross-sectional data

Incidence of asthma in different age groups was estimated based on cross-sectional data on current age of the responders and age at diagnosis of asthma [22, 23]. Longitudinal data were retrospectively reconstructed from the questionnaire data as if the 3967 subjects were a cohort of newborns recruited between 69 and 20 years ago. A "time-to-event" (age at diagnosis of asthma) was recorded for each individual, and the population at risk at each age was updated by subtracting both events (subjects reporting asthma diagnosed at younger age) and censorships (asthma-naïve responders younger than the age for which population at risk was calculated) from the total sample.

In brief, subjects were divided into 10-year age groups based on their current age, and annual incidence of asthma per 1000 person-years (new asthma diagnoses/1000/year) was calculated in each age group by dividing



the number of incident asthmas in each group by age-group-specific population at risk, dividing the result by 10 and further multiplying with 1000. The 10-year age group -specific population at risk was a mean value of annually calculated respective 10-year risks. With respect to age 0, population at risk was all responders. For ages 1–20 years, subjects reporting asthma diagnosed at younger age than the age for which the population at risk was calculated were subtracted to form the 1-year population at risk. The youngest responders were 20 years of age at the time of the study. After age 20, the responders who did not report physician-diagnosed asthma (i.e. asthma-naïve responders) and who were younger than the age for which the population at risk was calculated, were also subtracted from all responders to calculate populations at risk for ages 21–69 years.

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